Structural Analysis and Comparative Study of RCC & Composite Multilevel Parking

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Abstract: Now a day's composite steel concrete construction getting the word wide acceptance, as per the development needs advanced construction technology is used. steel concrete composite elements are extremely using in multilevel modern building. In this paper study the comparative multilevel parking analysis of steel concrete composite structure element like composite column steel beam deck slab and the analysis of multilevel rcc multilevel parking. parking structure is modeled by using ETABS-2015 software. For earthquake IS 1893:2002 is considered for the analysis. The seismic parameters for zone II. For the analysis of the parking structure considering the load for G+7 and study the analysis between the two different types of structural parameters like maximum displacement, maximum story drift, modal load Participation Ratios, fundamental time period.

Keywords — analysis, ETABS 2015, multilevel parking, rcc, steel concrete composite, seismic zone.

I. INTRODUCTION

In this moderate era of innovation.Most of the reinforced concrete structure are greater demands in India.as compared to another types of structure.but as per the current development needs advanced construction methodology like and steel concrete composite structure is widely used in to the industrial area but the ratio is low as compared to other countries because of the unawareness about the analysis and design of complexity.

In this paper the two different types of material elements use that is steel concrete composite material and rcc material application use for the analysis for G+ 7 multilevel parking structure which is located in aurangabad mahrashtra.

1.2 Objective of study

To identify the performance of the structure under the loading condition.to study the analysis between the two different types of structural parameters like maximum displacement,maximum story drift,modal load Participation Ratios,fundamental time period etc. which is done by using ETAB 2015

II. LITERATURE REVIEW

Ankit kumar 18 December 2021[1]The primary object of researchers in this project is to learn dynamic analysis of G+7 storey commercial building of uniform and optimized section,located at in seismic zone IV.

Response spectrum analysis method is used to analysis of rcc and composite structure, the ETABS (Extended Three-Dimensional Analysis of Building System) software used to and various results are compared such as time period, maximum story-displacement, maximum-story ,stiffness, maximum shear and maximum story four models are used for analyzing the response of building.

Prof. Ravi B Tilaganji 7 July 2020 [2]A case study is carried out for the improvement of existing condition of car parking in Bapat Galli, Belagavi. This is centrally located in the market. In this paper a study has been made for improving the car parking facility in Bapat Galli. A Multilevel car parking structure suitable for the requirement is considered for analysis. The analysis of the structure is carried out using Indian Standard Codes in STAAD Pro V8i software.

Phatale Swarup Sanjay 7July 2019 [3]The main aim of the researcher is to compare seismic response of the 3D g+8 story rcc ,steel and composite frame building suited in earthquake zone -V. The rcc slab is used in all three cases. Beam and column sections are made of either RCC, Steel or Steel-concrete composite sections. Equivalent static method and Response Spectrum method are used for seismic analysis. ETABS 2015 software is used and results are compared based on fundamental time period, displacements, base shear and storey drift. Comparative study based on seismic analysis concludes that, RCC

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construction is best suited for low rise buildings among all the three types of constructions.

Anargha.B.S 12 November 2019 [4]

In this paper the researchers is an attempt to study the behaviour of reinforced concrete,steel and composite structure under the effect of seismic loading.The combination of steel and reinforced concrete,there utilizing the unique characteristics of the two materials,generally results in structures of greater economy and safety than either material alone could achieve.

III. METHODOLOGY

In this paper the study object is the analysis and comparative study between the rcc multilevel parking combination of steel and reinforced concrete. The structural plan is drawn in as per the requirement in AUTOCAD-2018 as shown in fig.1.The parking structure is modeled by using ETABS-2015 software.

For earthquake IS 1893:2002 is considered for the analysis. The seismic parameters for zone II .design done as per IS 800: 2007 and IS 456: 2000 is used.for The steel and concrete composite parking structure and Rcc parking structure which is located in aurangabad mahrashtra

3.1 Planning Layout

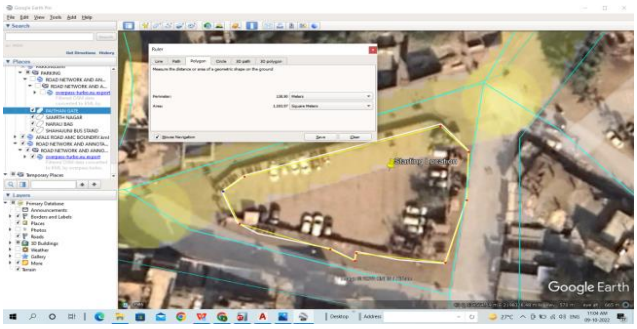


Fig. 1:Parking Area Located In Aurangabad city

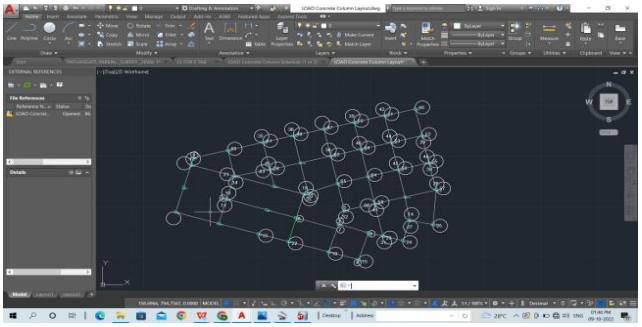


Fig.no.2: Structural plan in AutoCAD 2018

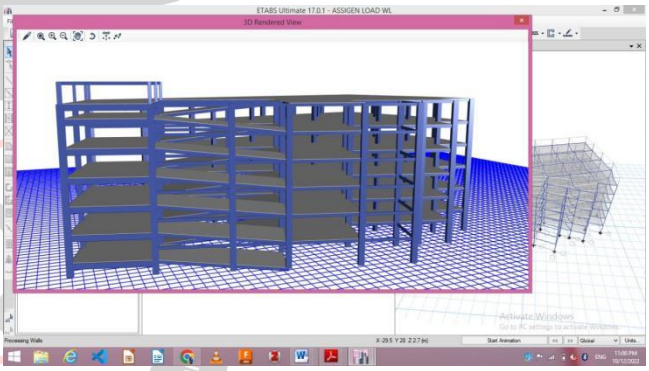
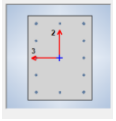


Fig.no.3: 3D Of The Parking Structure

3.2 Parameters Considered For RCC Modelling

Sr.no	Particulars	Dimension/Value
2	Total height of structure	18.2 m
3	Height of each story Height of head room	2.7 m 2 m
4	Thickness of rcc slab	150mm
5	Grade-of Longitudinal bar Grade of Lateral ties Grade of concrete column Grade of concrete beam Grade of concrete slab Density of Concrete	Fe500 FE415 M25 M20 M20 25 Kn/m
6	Size of Column C1 C2	 450X600mm

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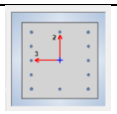
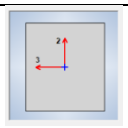
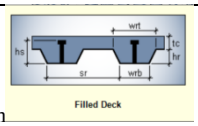
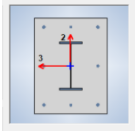
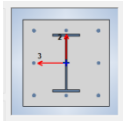
		 450X450mm
7	Size of beam B1	 400X450mm
8	Semitic zone Importance factor Zone factor Damping ratio	II 10 0.5 5%
9	Floor finish Live load Vehicle load	1kN/m 4kn/m 5kn/m
10	Density of Concrete	25 Kn/m

3.3 Parameters Considered For Composite modelling

Sr.no	Particulars	Dimension/Value
1	Area dimension	1010.40Sq.m
2	Total height of structure	18.2 m
3	Thickness of Deck slab	 150mm
4	Grade-of Longitudinal bar Grade of Lateral ties Grade-of concrete column Grade-of concrete beam Grade-of concrete slab Grade of steel Density of Concrete	Fe500 FE415 M25 M20 M20 Fe345 25 Kn/m
5	Grade of Longitudinal bar Grade of Lateral ties Grade of concrete column Grade of concrete beam Grade of concrete slab Grade of steel Density of Concrete	Fe500 FE415 M25 M20 M20 Fe345 25 Kn/m
6	Size of Column C1 C2	 ISMB300 450X600mm  450X450mm
7	Size of beam B1	ISLB600
8	Semitic zone	II

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	Importance factor Zone factor Damping ratio	10 0.5 5%
9	Floor finish Live load Vehicle load	1kn/m 4kn/m 5kn/m

3.3 Loading

For the analysis of the parking structure considering the load for G+7 that is dead load,live load,floor finishing load,vehicle load and the seismic parameters for zone II consider similar for Steel-concrete composite and rcc both type of structure.which is generated.as per the IS code provision by using ETABS-2015 software.

Sr.no	Load Combination Name	Scale factor
1	Dead load	1
2	Live load	1
3	Floor Finishing	1
4	Eartquick load	1.2
5	Vehicle load	1
6	Response-spectrum	1

Table no 1.: Load combination table

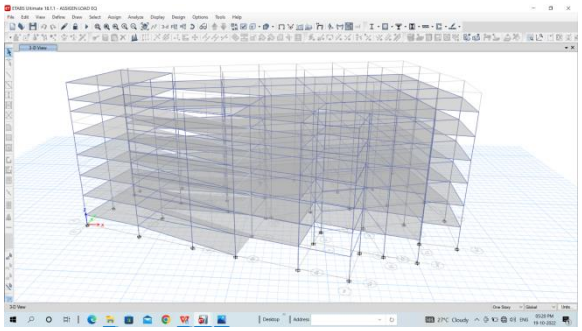

Fig.no4.: Undeformed Shape Composite Parking Structure

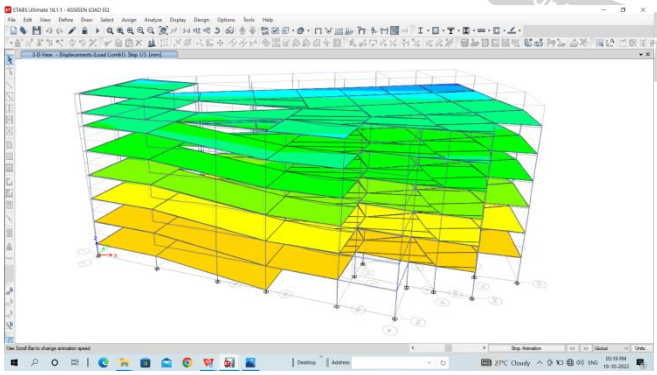

Fig.no5.: Deformed Shape Composite Parking Structure

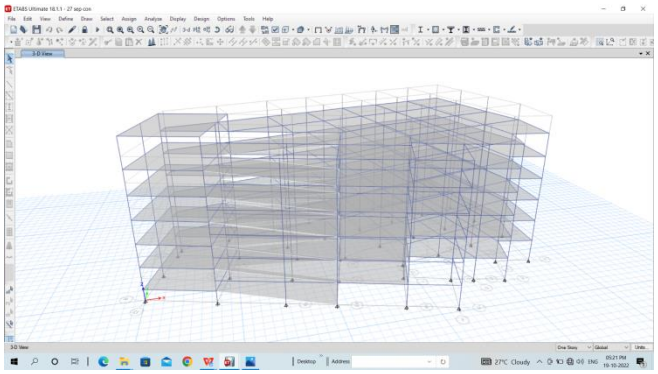

Fig.no 6.: Underperform Shape RCC Parking Structure

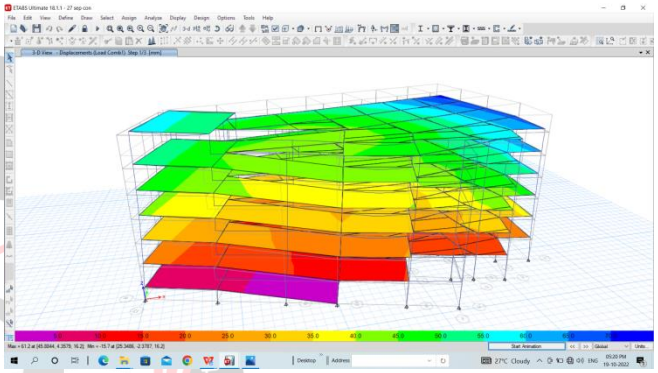

Fig.no.7: Deformed Shape RCC Parking Structure

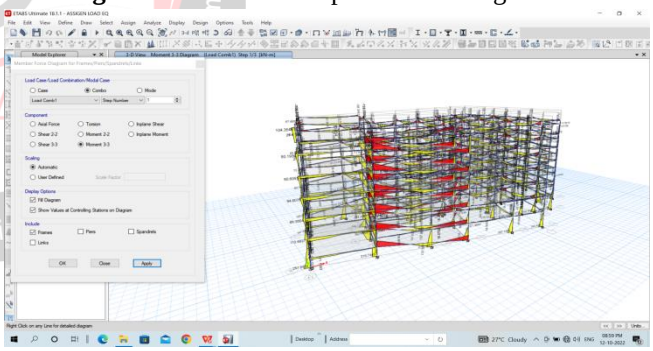

Fig.no.8: Bending moment of Composite parking structure

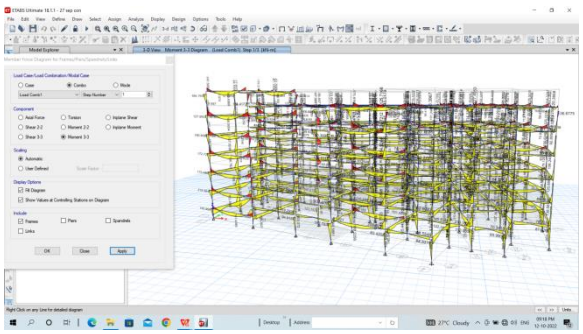

Fig.no.9: Bending moment of RCC parking structure

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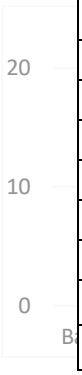
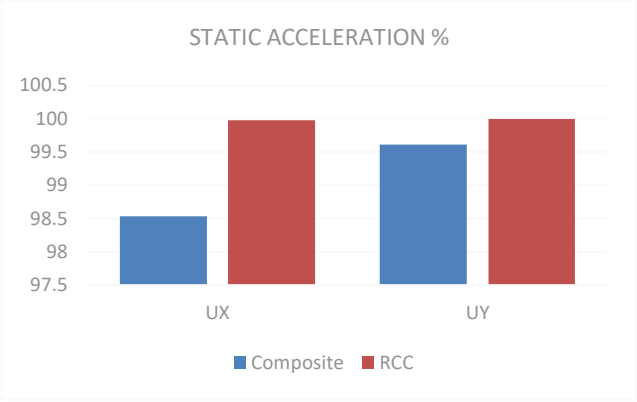
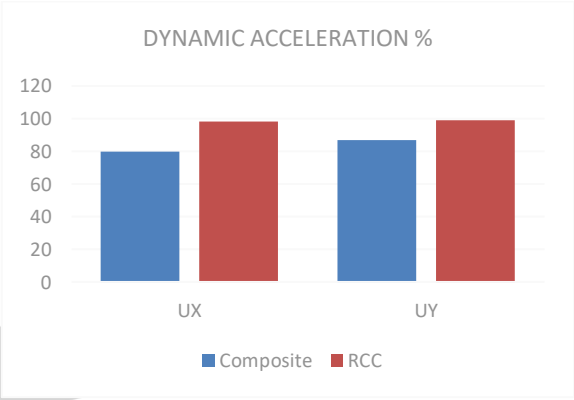
IV. RESULTS AND COMPARISON

4.1Maximum story displacement

Story	Elevation (m)	Composite (mm)	RCC (mm)
Story7	18.2	14.1	16
Story6	16.2	9	14
Story5	13.5	8.2	13.4
Story4	10.8	7	12.3
Story3	8.1	5.3	10.9
Story2	5.4	3.2	8.8
Story1	2.7	1.2	5.9
Base	0	0	0



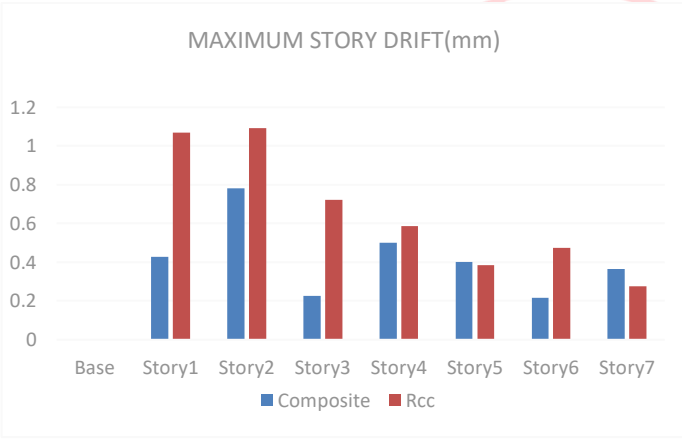




4.2 Maximum story drifts

Story	Elevation	Composite (mm)	RCC (mm)
Story7	18.2	0.363	0.276
Story6	16.2	0.216	0.474
Story5	13.5	0.4	0.383
Story4	10.8	0.5	0.586
Story3	8.1	0.224	0.720
Story2	5.4	0.781	1.092
Story1	2.7	0.426	1.169
Base	0	0	0

Table. 3 Maximum story drift



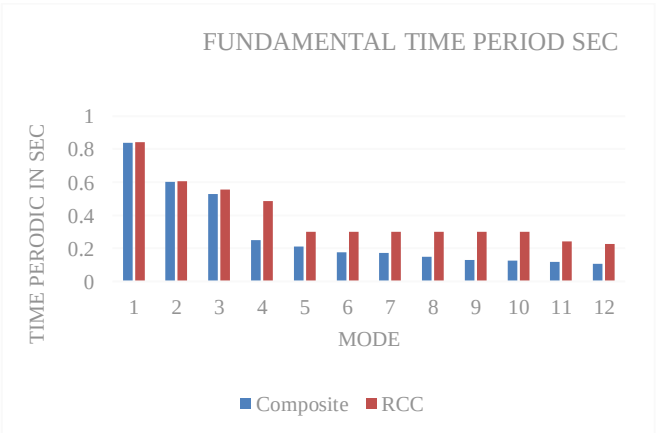
4.4 Fundamental Time Period (S)

Mode	Composite	RCC
1	0.836	0.84
2	0.603	0.604
3	0.53	0.554
4	0.248	0.485
5	0.212	0.3
6	0.177	0.3
7	0.174	0.3
8	0.148	0.3
9	0.129	0.3
10	0.126	0.299
11	0.119	0.241
12	0.107	0.228

Case	ItemType	Item	Static %(Composite)	Static %(RCC)
Modal	Acceleration	UX	98.53	99.97
Modal	Acceleration	UY	99.61	99.99

4.3 Modal load participation ratio

Case	ItemType	Item	Dynamic%(Composite)	Dynamic% (RCC)
Modal	Acceleration	UX	79.92	98.14
Modal	Acceleration	UY	87.03	98.86



V. CONCLUSION

1. The maximum displacement values are less in steel concrete composite structure compared to RCC hence

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it concludes that stiffness of composite structure in high compared to other parking structure

2. The maximum story displacement as per IS 456:2000 is 0.004H for the height of the building i.e. 18.2 m.The maximum story displacement form the analysis obtained is 14.1 mm for composite parking structure & 16 mm in Rcc structure which is well with in limit,hence the both parking structure is considered safe.
3. As the stiffness of composite members is high,the story drifts of composite structure are comparatively less than the rcc parking structure within permissible limits.
4. The maximum allowable story drift as per IS code is 0.7 to 0.25% of height,therefore the value so obtained for 18.2 m is (0.12 m to 0.0455 m) and the result obtained 0.000781 m for composite parking structure & 0.0011169 m which is well within the range of the building.
5. The static acceleration and dynamic acceleration is also less of composite parking structure than the Rcc parking structure
6. The displacement values are less for steel concrete composite parking structure so that the time period required is also less for composite structure as compared to Rcc parking structure
7. So as per the above analysis result the steel concrete composite parking structure is better than the Rcc parking structure
8. So as per the above analysis result the steel concrete composite parking structure is better than the Rcc parking structure.

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